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Journal of the Society of Arts.

FRIDAY, NOVEMBER 26, 1858.

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SECOND ORDINARY MEETING.

WEDNESDAY, Nov. 24, 1858.

The Second Ordinary Meeting of the One Hundred and Fifth Session, was held on Wednesday, the 24th inst., George T. Doo, Esq., R.A., F.R.S., in the chair.

Previous to the reading of the Paper, the Secretary called attention to some specimens of printing on veneers, for decorative purposes, exhibited by Mr. William Taylor, of Nottingham. The veneers are cut from a log, which revolves against a knife, by means of which a continuous sheet of wood, of considerable width, is obtained. When cut they are stated to require no planing; a much smaller portion of glue is necessary to mount them, and, after being made smooth with fine glass-paper, they are ready for French-polishing. These veneers are afterwards ornamented with designs printed by a lithographic or other surface-printing process, either in black or colours, so as to produce the effect of marqueterie and other kinds of inlaid work. Attention was also drawn to two paintings on glass, by Signor Agneni. The pictures are produced on the under surface of the glass, the remaining portion being silvered in the ordinary manner employed for mirrors; they are intended to be used for decorating the walls of rooms.

The Paper read was—

ON A METHOD OF RENDERING ENGRAVED COPPER-PLATES CAPABLE OF PRODUCING A GREATLY-INCREASED NUMBER OF IMPRESSIONS.

BY F. JOUBERT.

The art of representing objects by means of outlines cut into solid stone or metal, appears to have been practised from the remotest antiquity; the Nineveh inscriptions recently brought to light, the numerous monuments left by the Egyptians, their vases of gold and other metals, covered as they are with a variety of inscriptions and designs cut in deep intaglios, sufficiently prove the fact.

We have also the positive knowledge that precious metals, even steel, were frequently engraved upon by the Arabs, long before their civilization penetrated into Europe; their arms especially, and many splendid pieces of armour bearing elaborately cut designs and ornaments, are evidence of this. The Greeks, and in after times the Romans, practised the art of engraving on stone and metal extensively. Gem or precious stone engraving, to the origin of which it is difficult to assign a period, was cultivated by the Romans with a degree of perfection which has never been surpassed.

At a later date, the skill of the goldsmiths of the middle ages had introduced the practice of covering vases and cups of gold and silver with a great many ornaments, even portraits, cut into the metal in deep lines or ridges, which were afterwards filled up carefully with other metals in a state of fusion, so as to render them perfectly adherent. When the metal had cooled, the whole surface was submitted to a high polish, and displayed the ornaments in various tints of metal; sometimes a sort of black composition only was poured into the lines while in a liquid state, which soon hardened and answered the same purpose as metal. This process, then much in vogue in Italy, was called "niello," and when we are told that it was customary to take a rude impression, in clay or wax, of the work just completed, by means of some lamp black rubbed into the lines, in order to judge of the effect before resorting to the process of niellling, it is difficult to imagine that the discovery of the means of obtaining a more permanent impression should not have taken place earlier.

Before examining with the attention it deserves the development of this great discovery, perhaps it may not be out of place to offer a few general remarks.

When the different nations of the continent, especially Italy, were awakening to the new order of ideas which was shortly to inaugurate the splendid period which has been called "The Renaissance," when the thirst for learning and the desire for the possession of books, in those days scarce, and only to be had in manuscript, was such that men of great celebrity and erudition, Boccaccio amongst the number, could devote much valuable time in copying out whole volumes of the Latin authors—then, by an admirable order of Providence, who dispenses to us all gifts at the precise time that we are ready to receive them, the invention of the art of type-printing took place to supply the want generally felt, and books began to be diffused extensively.

In like manner, when the taste for pictures or for a representation in some shape or other of a design was steadily growing in the public mind, compositions and subjects, drawn firstly on a piece of hard wood, were carved out so as to show, in relief, the surface only, which had been delineated with the pencil or the pen, and by rubbing some black substance over the compositions thus standing in relief, and pressing heavily a piece of paper spread over it with the palm of the hand, something like an impression was obtained; yet, this means of reproduction from the wood block had not suggested the idea that intaglios cut into a plate of metal were capable also of yielding an impression, when an accident led to the discovery of a process, the value of which it is not easy to overestimate, considering the immense development the invention has received.

There is no possibility of dispute as to the date of the invention attributed to Tomaso Finiguerra, the Florentine goldsmith: the little print, extremely rare, whch can be seen at the Imperial Library, at Paris, bearing the inscription "1452," and supposed to be the oldest print from a metal plate now in existence, disposes of this point; the manner also in which the discovery took place is known. Finiguerra, having completed some elaborate piece of engraving on silver, had filled the intaglios with a black composition in a soft state, and after cleaning out carefully the surface of the metal so as to leave the black only in the engraved part, he had occasion to absent himself from the workshop for a short time; a girl passing through the room with some wet clothes chanced to let fall a piece of wet linen on the very work that was lying on the table. When Finiguerra, on his return, lifted up the linen, he perceived, to his great amazement, a perfect impression of the ornaments he had been engraving transferred to this piece of linen. A world of new ideas was at once opened to his mind; he tried to accomplish designedly that which had been the result of accident, and, after a great many attempts, succeeded in producing a correct impression on *wet paper*.

Such an important discovery could not remain long secret; several artists of that time tried their hand at the new art, and a few years later, in 1477, the first book containing impressions from engraving on metal was published at Florence.

The art of engraving was practised with success in many places from that early period, and especially at Rome, where a celebrated artist, Andrea Mantegna, already known from his numerous pictures, many of which have been transmitted to us, took up the burin, and in translating his own works on copper, produced those admirable plates in which the talent of the painter is combined with that of the engraver.

In Germany, also, Martin Schoen published, as early as 1460, his first prints, and was long considered by his friends and contemporaries as the inventor of the art; his disciples and imitators were many; the art was likewise practised at Munich, at Nuremberg, in which last place Albert Durer, from a very early age, had shown such a natural taste for the culture of the fine arts that his father, a goldsmith by trade, allowed him to leave his workshop for the studio of Michael Wohlgemuth, where he learned to paint and engrave, and soon made rapid progress. He began by copying the compositions of his master, but soon engraved from his own designs with surprising success.

The reputation of Albert Durer had already extended far, when he married, in 1494, but his domestic life was far from being a happy one, and from time to time, in order to escape from his family troubles, he undertook several journeys, once to Holland, where he was received as a brother by Lucas, of Leyde, who was a great admirer of his works; another time he went to Venice, where, to his great mortification he found that spurious copies of his own works were publicly sold, bearing his own signature or monogram; Albert Durer traced out the unprincipled individual who was practising the fraud, lodged a complaint before the tribunal and he was punished. His name was Marc Antonio.

A few years later, in testimony of the high esteem in which he held Albert Durer, Raphael sent him a present of a series of prints, which the illustrious artist had had executed from his own compositions, and under his immediate direction by the same Marc Antonio, whose name had already become celebrated.

Marc Antonio, born at Bologna, had spent his early years in a goldsmith's shop, when he was offered an engagement to go to Venice and work for a goldsmith and engraver of that place; he there had occasion to see some impressions of Albert Durer's engravings, which perfectly astonished him; not satisfied with copying those for improvement, he soon went even further, for, as we have seen, he was detected by Albert Durer himself, in passing off and selling his own copies for the originals.

Soon after this, Marc Antonio went to Rome, where he was introduced by Giulio Romano to Raphael, who was so pleased with his talent as an engraver that he gave him some of his compositions to translate on copper. Marc Antonio's works have never been superseded, and to this day are held in high repute by all lovers of true art. He had a considerable number of pupils from all parts of the continent, and, although the death of Raphael caused a temporary check in his career, by putting a stop to the extensive works he was engaged upon from Raphael's compositions, yet, under the guidance of Giulio Romano, he published many fine works, but after a very checkered life, having resorted to his former practice of copying and signing a composition which was not his own. the rightful proprietor of the plate, instead of imitating Albert Durer, and applying for redress to the courts of law, sought Marc Antonio, and, running him through the body, killed him on the spot.

In Holland and Flanders, Lucas of Leyden, and soon after Wosterman, Pontius, and Bolswert, published numerous engravings, the reputation of which was, for a time, almost superseded by the great success of Rembrandt's etchings, which success the lapse of two centuries has not in any way diminished.

In France, the art of engraving, which, for many years, had made no progress, seemed to receive a fresh impulse from the talent of Jacques Callot, whose admirable etchings are well-known, and also from the etchings and engravings of Claude Lorrain, Poussin, Lesueur, and Valentin.

In England, with the exception of Hollar, there is scarcely any name of note to be mentioned, although engraving was much cultivated, especially by foreign engravers, and Hollar, after having published a vast number of engravings, chiefly illustrating books, died at the age of sixty.

The last century produced many engravers of great merit, and in this country foremost amongst them are Hogarth, Sir Robert Strange, and James Heath. The excellence of their works gave rise to such a demand for print impressions of engravings, that some forty years ago, when it was found that a copper plate could not yield a sufficient number of impressions for the demand, steel plates were introduced, for small plates only at first, and several editions of books were published containing plates most elaborately engraved on steel.

Subsequently, when means were found to obtain a large surface of steel of pure quality, this metal was adopted for the style of engraving known as mezzotinto, which is now practised on steel plates, the result being a much larger number of impressions obtainable as compared with the old copper plates; but historical or line engraving for important subjects was still entirely practised on copper, when the discovery of the art of electroyping took place, towards the year 1838.

Several line engravings on copper were then multiplied by this process; the result, however, was only attended with partial success, in consequence of the soft quality of the copper so deposited, which will yield but a very limited number of good impressions, and soon wears away; this caused the process to be almost abandoned for artistic engraving, but for commercial purposes it is still practised extensively, and has been often successfully applied in cases where a large number of impressions is not required.

Under the circumstances which I have described, it had become a desideratum to harden, if possible, the surface of a copper plate, and to protect it from wear while printing, but it is only lately that this important object has been attained.

In March last my friend M. Jacquin, of Paris, took out a patent in this country for a method of coating plates with iron, which had already been successfully applied in France, and of which the merit is due to my friend, M. Henri Garnier, of Paris.

I have myself had the advantage of co-operating with M. Garnier in the development of the invention, the principles of which I shall now proceed to describe:—

If the two wires of a galvanic battery be plunged separately into a solution of iron, having ammonia for its basis, the wire of the positive pole is immediately acted upon, while that of the negative pole receives a deposit of the metal of the solution—this is the principle of the process which we have named "acierage."

The operation takes place in this way:—By placing at the positive pole a plate or sheet of iron, and immersing it in a proper iron solution, the metal will be dissolved under the action of the battery, and will form hydrochlorate of iron, which, being combined with the hydrochlorate of ammonia of the solution, will become a bichloride of ammonia and iron; if a copper plate be placed at the opposite pole and likewise immersed, the solution being properly saturated, a deposit of iron, bright and perfectly smooth, is thrown upon the copper-plate, from this principle:—

Water being composed of hydrogen and oxygen;

Sal ammoniac being composed of

1st. Hydrochloric acid containing chlorine and hydrogen;

2nd. Ammonia, containing hydrogen, nitrogen, and oxygen;

The water is decomposed under the galvanic action, and the oxygen fixes itself on the iron plate, forming an oxide of iron; the hydrochloric acid of the solution acting upon this oxide forms a hydrochlorate of iron, whilst the hydrogen precipitates itself upon the plate of the negative pole, and, unable to combine with it, comes up to the surface of the solution in bubbles.

My invention has for its object certain means of preparing printing surfaces, whether for intaglio or surface printing, so as to give them the property of yielding a considerably greater number of impressions than they are capable of doing in their ordinary or natural state. And the invention consists in covering the printing surfaces, whether intaglio or relief, and whether of copper or other soft metal, with a very thin and uniform coating of iron, by means of electro-metallurgical processes. The invention is applicable whether the device to be printed from be produced by engraving by hand, or by machinery, or by chemical means, and whether the surface printed from be the original or an electrotype surface produced therefrom. I would remark that I am aware that it has been before proposed to coat type and stereotypes with a coating of copper, to enable their surfaces to print a larger number of impressions than they otherwise would do; I therefore lay no claim to the general application of a coating of harder metal on to the surface of a softer one, but my claim to invention is confined to the application of a coating of iron by means of electricity on to copper and other metallic printing surfaces.

In carrying out the invention the solutions of iron employed may be varied, and such is the case in respect to the arrangement of the galvanic battery or other source of electric currents used; I do not therefore limit the invention to the means herein-after described, but I believe they will be found to be the best for the purpose.

I would further remark that it is important that a ferric solution should be employed which will not dissolve or corrode the plate intended tc be coated, for if it be attempted to use such a solution, though the iron will be precipitated, it will not only be in a non-coherent state, but the engraved surface itself will be liable to be attacked and injured. It may also be remarked that the coating of iron admits of being removed from a printing surface of copper without injury to the original plate, hence the original plate may, after being coated and used for some time, have the worn coating removed, and then be re-covered with an iron coating as often as may be required; and if care is taken to remove the coating of iron before it has been entirely worn away, the engraved copper or other plate may be made to print a vast number of impressions and yet remain in the original state it was in when it left the hands of the engraver, or was otherwise first produced; the only limit appears to be in the gradual change which takes place in the body of the printing surface by the compression to which it is subjected in the process of printing. Heretofore, in respect to plates engraved in intaglio, if of steel, they each yield on the average about 3000 impressions without retouching; if of copper they each yield on an average not more than 800 without retouching; whilst electro casts of copper obtained from the originals will not on an average each yield even 200 impressions without retouching; in fact such printing surfaces are so easily worn, that after the first hundred or 150 impressions there is a considerable deterioration in the quality of the work produced. Therefore, for the supply of the number of impressions often required by art associations and others, it has been found necessary to multiply the electro casts very considerably. In such cases the invention is applicable with considerable advantage, for I find that an electro plate 40×22 inches covered or coated with iron has yielded 2000 impressions without its being necessary to remove and renew the iron coating, there being no perceptible difference between the first and last impression, the work on the plate appearing not to have suffered in the slightest degree. Hence in future, by the application of the invention, it will only be necessary to multiply electro casts to such an extent as may be necessary to ensure the production of prints or impressions with the requisite speed on paper, calico, or other fabrics. At the same time an original engraving on copper would become, when treated according to the invention, more lasting than if engraved on steel. Although original surfaces engraved in relief, and also electro and other casts taken from them, yield a considerably greater number of impressions than those I have mentioned as obtained from plates engraved in intaglio, to which the invention has not been applied, nevertheless the invention is applicable with great advantage to such relief printing surfaces, whether of copper or other soft metal, for if they be coated with iron according to the invention they will yield almost an indefinite number of impressions, provided the iron surface be renewed as often as may be necessary, and the printing surfaces be again re-coated.

In carrying out the invention I prefer to use that modification of Grove's battery known as Bunsen's, and I do so because it is desirable to have what is called an intensity arrangement. The trough I use for containing the solution of iron in which the engraved printing surface is to be immersed in order to be coated is lined with gutta percha, and it is 45 inches long, 22 inches wide, and 32 inches deep. In proceeding to prepare for work, the trough, whether of the size above mentioned or otherwise, is filled with water in combination with hydrochlorate of ammonia (sal ammoniac) in the proportion of one thousand lbs. by weight of water to one hundred lbs. of hydrochlorate of ammonia. A plate of sheet iron, nearly as long and as deep as the trough, is attached to the positive pole of the battery and immersed in the solution. Another plate of sheet iron, about half the size of the other, is attached to the negative pole of the battery, and immersed in the solution, and when the solution has arrived at the proper condition, which will require several days, the plate of iron attached to the negative pole is removed, and the printing surface to be coated is attached to such pole, and then immersed in the bath till the required coating of iron is obtained thereto. If, on immersing the copper plate in the solution, it be not immediately coated with a bright coating of iron all over, the bath is not in a proper condition, and the copper plate is to be removed and the iron plate attached and returned into the solution. The time occupied in obtaining a proper coating of iron to a printing surface varies from a variety of causes, but a workman after some experience and by careful attention will readily know when to remove the plate from the solution; and it is desirable to state that a copper plate should not be allowed to remain in the bath and attached to the negative pole of the battery after the bright coating of iron begins to show a blackish appearance at the edges. Immediately on taking a copper plate from the bath great care is to be observed in washing off the solution from all parts, and this I believe may be most conveniently done by causing jets of water forcibly to strike against all parts of the surface. The plate is then dried and washed with spirits of turpentine, when it is ready for being printed from in the ordinary manner.

If an engraved copper plate be prepared by this process, instead of a comparatively limited number of impressions being obtained and the plate wearing out gradually, a very large number can be printed off without any sign of wear in the plate, the iron coating protecting it effectually; the operation of coating can be repeated as many times as required, so that an almost unlimited number of impressions can be obtained from one plate, and that a copper one.

This process will be found extremely valuable for electrotype plates and also for photogalvanic plates, since they can be so protected as to acquire the durability of steel, and more so, for a steel plate will require repairing from time to time, these will not, but simply recoating whenever it is found necessary; by these means one electro copper plate has yielded more than 12,000 impressions, and was found quite unimpaired when examined minutely.

It is easy to appreciate the importance of this invention as applied to artistic or line engraving more especially, for a copper plate being once engraved, if submitted to the acierage process, will become a lasting property, not liable to deterioration by printing, and the public may expect to be supplied with the very best impressions at a more moderate charge, whilst to the numerous branches of commercial engraving, for the ceramic manufactures and others, as well as to the vast number of old engraved copper plates existing in this country, this process is likely to confer an immense additional value.

I need not say that copper is by no means the only metal to which the process is applicable, for the same principle will be found to answer in the case of other soft metals used for printing purposes, and I shall only add, in conclusion, that although the principle of electrotyping has been applied up to the present date in a variety of ways since it was organized by Thomas Spencer, in 1837, this is, I believe, the first time that an attempt has been successfully made to prepare an engraved copper plate with harder metal, with the view of increasing its printing capabilities, and I feel happy to have been the first to introduce so valuable a discovery into this, my adopted country.

DISCUSSION.

Mr. George Godwin, F.R.S., had listened with great pleasure to Mr. Joubert's paper, as no doubt all present had done. The introductory portion of it brought to his mind that admirable collection of engravings which was exhibited last year at Manchester, wherein the progress of the art was so well shown, and he could not but express a hope that the authorities of the British Museum would do that which had long been urged upon them, viz., provide proper apartments in which might be exhibited specimens of the English school of engraving, which was so worthily represented by the Chairman and other gentlemen whom he saw there that evening. Passing to the more practical points of the paper, he would remark, in the first place, that he thought it ought not to be inferred that steel was only used in the present day for small plates. He believed it was also extensively used for large engravings, although the engraver would probably be glad to get rid of this metal and return to the use of the softer material, copper, if a sufficiently large number of impressions could be taken from it, and this was the great point to be considered in estimating the value of the invention before them. He did not think Mr. Joubert was quite right in attributing the failure of the electrotype process to the softness of the electrotype plates. It was stated by Mr. M'Queen, in his evidence before a Committee of the House of Commons, that the electrotype plates gave as many impressions as the original copper plate itself. The Council of the Art Union of London had adopted the electrotype process at a very early period of its introduction, and, in some cases, with perfect success. For instance, in the case of the plate of Raphael and the Fornarina, engraved by Lumb Stocks, there were fourteen electrotype plates taken from it, which produced 14,000 successful impressions. He believed 1,100 impressions was the maximum taken from any one of these electrotype plates, which was a very large number; it was true that some touching of the plates was required. He believed that was as large a number as could be taken from the original plate. The point he wished more particularly to dwell upon was this, that the softness of the plate was not the cause of failure; but in producing the original there was frequently a considerable amount of under-cutting, where the line was wider at the bottom than at the top, so that when the matrix was removed from the plate, there was a certain amount of tearing off from the surface, and he believed it was that circumstance chiefly which had led to the idea that the electrotype process was a failure. They would see that, inasmuch as Mr. Joubert's process started with the use of electrotype plates, it was necessary that the inconvenience in that process which he had pointed out should be understood, in order that it might be guarded against. He feared, looking to the process exhibited that evening, that if the plates were suffered to remain too long in the bath there was danger of the finer lines of the plate becoming partially filled up. He thought a good test would be to take an impression from a plate just out of the hands of the engraver, and before being coated by this process, and also an impression from it after having been coated with iron. He begged the meeting to understand that he had not made these observations in a spirit of opposition to this invention. He was one of those who thought fine works of art could not be too largely distributed, although, in a commercial point of view, he believed this was not considered desirable by some; but it was his desire to see them spread far and wide, and every invention that would tend to cheapen works of art must be welcome to all true lovers of art.

Mr. Joubert remarked that he had been misunderstood if, as stated by the last speaker, he had represented that his process was more particularly intended to be applied to the electrotype plate on account of its softness. It was equally suitable for the original plate, and, as an example, he might state, that the original plate of the engraving behind him (The Playground) had been coated by this process six months ago, and from it he believed 5,000 impressions could now be taken without its being necessary to renew the coating. With regard to the remark that the electrotype plates would yield as many impressions as the original plate, he begged to say that he had with him two impressions of an engraving which went to prove that this was not the case. Refering again to the engraving exhibited, which belonged to the Art-Union of Glasgow, the impression they saw was the artist's proof from the original plate just after the engraving was completed, and here [producing another copy] was an impression taken from the electrotype plate coated by his process. The impression he exhibited was taken when there had been 2,300 printed off, and when examined he did not think that any real difference would be perceived between that impression and the artist's proof. Here [producing another copy of the same engraving] was a bad impression from the electrotype plate not coated, which began to fail after 240 impressions, and completely failed after 400. It was true that electro deposits were better than others, but he believed that, on the average, the number at which the electrotype plates began to fail was from 250 to 300, whilst from the original plate of beaten copper as many as 800 impressions might be taken without "touching."

Mr. Godwin said he had merely stated the fact as it occurred; that in the case of the plate he had referred to, 1,100 copies were taken from the electrotype plate. It was true that frequent "touching" was found necessary.

Mr. Joubert believed his professional brethren present would bear him out, that, if in the instance alluded to, as many impressions were taken from the electrotype plates as from the original plate, it was a very remarkable case. He had known so many "touchings" to be given to a plate that scarcely a particle of the original work remained.

Mr. M'Queen could confirm the statement of Mr. Godwin, with regard to the engraving alluded to, namely, that the electrotypes yielded as many impressions as the original plate.

Mr. Joubert added that Mr. Godwin was quite correct in stating that one of the chief drawbacks of the process of electrotyping was when undercutting occurred in the original plate, but when a plate was engraved with the view of being electrotyped, it was easy for the engraver to avoid undercutting and to secure a good matrix being taken from the plate without tearing off any of the lines.

Mr. Varley expressed a high opinion of the value of this invention.

Mr. Joubert said, that Mr. Godwin seemed to fear that there was danger of the fine lines of an engraving being filled up by the process of metallic coating. By way of experiment, he had tried to deposit a very thick layer of metal upon a plate, without regard to the filling-up of the lines, and he found that it was hardly possible to fill them up.

The Rev. Walter Mitchell begged to inquire how far this invention had been tried commercially, and with what results?

Mr. Joubert admitted the importance of the question just put to him, to which he thought he could not give a better answer than was afforded by a letter which he received two days ago from Mr. Henry Bohn, the well-known publisher, of York-street. Mr. Joubert then quoted from the letter, which stated that no one was more alive than the writer to the value of this discovery. Although he had urged on experimentalists to find out some means of hardening copper-plates, he had never anticipated such success as had been achieved by this process. He had had several of his old copper-plates coated, and was gratified to find that the operation had been entirely successful, reproducing the engraving without any loss of the original delicacy, and yielding a large number of impressions. He (Mr. Bohn) was now testing it upon plates which, but for this process, would be worthless.

Mr. J. Jenkins inquired whether this process had been as yet applied to the engraved plates for porcelain.

Mr. Joubert replied that at the present moment it was being applied with success by one of the largest firms in Staffordshire. He had coated one plate about six weeks ago, and he had received an intimation that the experiment had been so far successful that another plate would be sent to undergo the same process previous to its being printed from.

Mr, Jenkins added that his reason for asking the question was because some years ago it was considered desirable by the pottery manufacturers to supersede the necessity of having a large number of copper plates engraved with the same design. At that time he suggested the use of steel plates instead of copper, but it was found that they were obliged to cut the lines so deep, in order to hold the large amount of colouring matter necessary, that there was great difficulty in using this hard metal. A further objection to the use of steel plates in that class of manufacture was that the smoothness of the surface prevented them from holding the oily description of colouring matter used. In the ordinary mode of printing, the cleaning of the surface of the plate was performed by the hand, but in pottery work the plate was scraped with a spatula, and by that process the oily ink was apt to be dragged out of the lines. He thought the objection he had alluded to might be obviated by merely coating the surface of the plate with steel, not penetrating to the incised parts of the plate. The incisions would then remain copper, which would retain the coloured printing material, whilst the portion exposed to the friction of cleaning would be coated with steel.

Mr. Joubert said the objection to coating the surface of the plate would be that the spatula would just catch the engraved lines, which, not being protected, would become worn. This was one of the objects of coating not only the surface of the plate, but the incised parts also. The same remark applied to ordinary copper-plate printing as well as to the class of work alluded to by Mr. Jenkins.

Mr. Blackwood inquired whether the process had been applied to ordinary printing types and stereotype plates?

Mr. Joubert replied that several plans had been tried for coating types with other metals—such as copper; but as it was known that ordinary printing type would endure a very large amount of wear, it was thought that there was no absolute necessity for applying this process. Stereotype plates also yielded a large number of impressions, and if they became worn out another set of plates could be made at a small expense. The process, however, was capable of application to type-metal, as to any other description of metal.

Mr. Le Keux was aware that for pottery work there was some difficulty in using steel plates. In a mercantile point of view, therefore, he had no doubt that this process could be brought into extensive use, not only in the potteries, but also in Manchester, where copper printing cylinders were so much used; but he thought in the higher branches of engraving, except in the illustration of historical works, although artists would lose nothing by this invention, they would be slow to adopt it until it had been put to some more severe test than he had heard of. The experiments, as far as they had at present been carried, appeared to have been made with old plates, which had, as it were, been resurfaced. With reference to the remarks of Mr. Godwin, relative to the failure of electrotype plates owing to the undercutting, he begged to say that this was a mistake. Many engravers present would bear him out that the beauty of a finished plate, the tone, the air, and the finish was got by the burnisher, and the under-cutting alluded to was not produced by the graver, but by the action of the burnisher.

Mr. Godwin said he simply stated that the undercutting existed, which had the effect upon the electrotype plates that he had mentioned.

Mr. Le Keux continued:—This process was an addition to the surface as well as to the lines of the plate, and he repeated that he was anxious to see it put to a severe test. For mercantile purposes probably 99 persons out of 100 would not know the difference between an impression frem the original plate and one from the coated plate; but he wished to see the experiment tried with a plate of high character, and that the results should be submitted to really competent judges. If this test then showed that the process neither robbed the whites nor the blacks, nor filled up the interstices, it might be considered satisfactory. He had not heard that the experiment had been tried to any extent with high class plates. It might be that persons hesitated to expose plates of such high value to the risk of coating, but he could easily understand that those who had a stock of old plates on hand, from which scarcely a hundred impressions could be taken, would be very glad to subject them to a process which would enable them to print off thousands.

Mr. Joubert said he was most anxious to have the opportunity of testing his process upon a plate fresh from the hands of the engraver. As yet he had not tried the experiment upon fresh plates, except upon some of his own, which had been engraved about 12 years ago, and from which only a few impressions had been taken. In the case of these experiments, he, in the first instance, took an impression from the original plates, after which he submitted them to the process of coating, and took another impression. These two impressions were afterwards shown to his friend the chairman, who would, no doubt, kindly state what had occurred with reference to them.

The Chairman said, this being a very important question as far as Mr. Joubert was concerned, he might be permitted to say that the proof which he had selected as being the impression from the original plate, and which he judged to be the best, turned out to have been taken from the coated plate, so that if there was any difference at all the palm of excellence was, in that instance, on the side of the latter.

Mr. William Humphreys remarked, that a previous speaker had referred to the facility with which colouring matter was removed from the plates used in printing for pottery purposes. In ordinary copper-plate printing, a very viscid quality of ink was used, and he recollected the difficulties experienced in the early stages of steel-plate printing on that account, but by the adoption of a suitable ink, the one description of plate was now worked as easily as the other. The great advantage of Mr. Joubert's process he conceived to be this—that, the plate having a steel surface, the ink could be wiped from it previous to printing, with a less amount of friction than was the case with copper-plate, which held the ink more tenaciously, whilst undoubtedly a greater number of impressions could be obtained from a plate treated by this process.

Mr. Winkworth would be glad to have the further confirmation of so high an authority as that of the chairman upon the point mentioned by Mr. Joubert, viz., that the impression taken from the coated plate was, in all respects, equal to that taken from the original plate.

The Chairman said he could easily satisfy Mr. Winkworth upon that point. He understood the capabilities of Mr. Joubert's invention to be this—that an impression might be taken from a copper-plate in whatever condition it might be, whether direct from the hands of the engraver, or after a number of impressions had been taken; it might then be coated with the steel and another impression might be taken, and he understood Mr. Joubert to state that the impression would be identically the same in appearance. As to this being the fact, he could only repeat what he had already stated, viz., that in two specimens that were submitted to him, he selected as the better impression of the two that which had been taken from the steel-coated plate. It undoubtedly was the better of the two, although this might have arisen from some accidental circumstance.

Mr. Yates suggested that a satisfactory test could be afforded by printing with a portion of the plate uncoated. It would then be seen on which side the advantage lay.

Mr. Joubert said that experiment was about to be tried in the course of a few days by Mr. Virtue.

Mr. Winkworth had been requested to ask one other question, viz., whether the recently-published engraving of the execution of Lady Jane Grey, after Paul Delaroche, had been worked from a plate which had been subjected to Mr. Joubert's process, and whether the greater number of impressions had not been printed from the coated plate.

Mr. Joubert replied that the engraving alluded to had been a considerable number of years in hand. It was the work of an Italian artist, who began it 25 years ago, and though not constantly engaged upon it, worked at it for many years. The result was, that when the plate was finished, owing to the long time occupied upon it, either from the friction of the sleeve or the hand of the artist, the plate was very much worn, and a well-known printer in Paris, to whom the execution of the work was entrusted by the publisher who had purchased the plate, made the startling announcement that he could not produce more than 75 or 80 impressions from it. That was a most serious matter with regard to an engraving that had cost between £3,000 and £4,000, as the publisher could put no price upon the impressions to repay him for his outlay. The consequence was that the plate was electrotyped. Four plates were successfully taken, and from those the publisher intended to print the limited number of 300 copies, upon which a price would be put to repay him for the cost of the engraving. Having, however, heard of this process, he called upon M. Garnier, the inventor, and asked him to undertake an experiment with his plate. At that time the process had not been tried upon any plate of consequence, and M. Garnier felt a little nervous about it. He was however prevailed upon to try it upon the four electro-types. Impressions were taken before and after the coating, which were submitted to the principal engravers in Paris, who pronounced the experiment entirely successful—they, in fact, said they could detect no difference between the two.

The Chairman said it was now his agreeable duty to propose a vote of thanks to Mr. Joubert for the Paper he had read, and he thought the frank, truthful, and, he might add, understating spirit which had characterised all that he had said, entitled him to their respect, as well as to their thanks. With regard to this, he must call it, important process, he thought it might be considered one of the great discoveries of the age. Very analogous to this was the discovery made a few years ago, also in Paris, of a material for indurating stone, which had since been extensively carried out, and he believed that architects might now defy the efforts of the elements and of time upon their structures. With regard to Mr. Joubert's process, the point which had principally occupied their attention, was its capability of producing impressions from the coated plates equal to those from the uncoated plates, and on this he (the Chairman) had given his opinion. The other important point was, the durability which it imparted to the plates, and the quality it gave of multiplying copies to a considerable extent. But the pretensions of the discovery were yet greater ; in fact he saw no limit whatever to the working of plates when subject to this process. As soon as one coating exhibited symptoms of wear, it could be removed and another coating put on; and, inasmuch as the printer could detect the slightest tendency to failure, the work could be stopped at any time, and thus the plate would be kept in a condition to produce impressions equal to proofs throughout the entire publication. If he was correct in what he had stated—and, so far as his knowledge enabled him to judge, he was so, he was sure he need only to invite them to accord their thanks to Mr. Joubert for having brought before them so important and so valuable an addition to the scientific discoveries of the present age.

A vote of thanks was passed to Mr. Joubert.

The Secretary announced that, on Wednesday evening next, the 1st of December, a Paper, by Mr. Hyde Clarke, "On Copper Smelting," would be read.

GUTTA PERCHA.

The following communication has been received from Don Jose D'Almeida, and has been laid before the Council:—

To the Secretary of the Society of Arts.

Sir,—I have noticed in the catalogue of the Exhibition of 1851, that the late Dr. W. Montgomerie was named as the first who introduced gutta percha into Europe. As gutta percha is now playing so important a part in the advancement of science and cultivation, it is proper that the public should be acqainted with its true history, and that honour should be rendered to whom honour is due.

I therefore think it my duty to draw public attention to the fact that my late father (Dr. Jose d'Almeida) was the first to introduce gutta percha to the notice of scientific men in England,—by presenting specimens to the Royal Asiatic Society of London, as an article possessing novel and peculiar properties, previous to the time when Dr. Montgomerie brought his specimens to Europe.

When my father first saw this article in the hands of the natives he was so impressed with an opinion that it had properties of great value to science, that he submitted specimens to some commercial and scientific friends, long before he presented those to the Royal

Asiatic Society of London; in proof of those statements I beg to refer you to the Royal Asiatic Society's Transactions (copy of the Secretary's note enclosed), and to the notices by Mr. Oxley, in the Journal of Indian Archipelago, vol. 1, pp. 22 and 78 (extracts of which herewith).

I beg, therefore, to request that proper notice of this fact should be made public through your Society, and remain, Sir, yours, &c. J. D'ALMEIDA.

Extract from the Journal of the Indian Archipelago, vol. i. page 22; notices by Mr. J. Oxley, A.B., senior surgeon of the Straits settlement of Prince of Wales's Island, Singapore, and Malacca:—

"Although the trees yielding this substance abound in our indigenous forests, it is only four years since it was discovered by Europeans.

"The first notice of it appears to have been by Dr. Wm. Montgomerie, in a letter to the Bengal Medical Board in the beginning of 1843, wherein he commends the substance as likely to prove useful for some surgical purposes, and supposes it to belong to the fig tribe. In April, 1843, the substance was taken to Europe by Dr. D'Almeida, who presented it to the Royal Asiatic Society of Arts[*] of London, but it did not at first attract much attention, as the Society simply acknowledged the receipt of the gift, whereas, shortly after, they thought proper to award a gold medal to Dr. Montgomerie for a similar service.

"Now as the discovery of both these gentlemen rested pretty much upon the same foundation,—the accidental falling in with it in the hands of some Malays, who had found out its greatest peculiarity, and, availing themselves thereof, manufactured it into whips, which were brought into town for sale,—there does not appear any plausible reason for passing over the first and rewarding the second.

"Both gentlemen are highly to be commended for endeavouring to introduce to public notice a substance which has proved so useful and interesting."

[Extract from page 78.]

"Dr. D'Almeida left Singapore for Calcutta in the latter end of November, 1842, arrived at Calcutta in the end of December of the same year; left Calcutta in the middle of July, 1843, by the steamer *Hindoostan*, and arrived at Southampton about the end of March.

"A few days before leaving Singapore, he bought from the natives some whips made of the Gutta Percha; some of the prepared substance, and some of it in its primitive state—this specimen being presented for the first time for sale at Singapore.

"During Dr. D'Almeida's passage to England, he gave a piece of this specimen to Mr. Charles Carnie, then a passenger in the same steamer, who, although a resident of Singapore, was unacquainted with this product.

"In London Dr. D'Almeida gave a portion of the specimens to Mr. W. C. Crane to be analysed, and about the end of April, 1843, presented the remainder to the Royal Asiatic Society. A letter of acknowledgment from the Secretary was transmitted to Dr. D'Almeida, which he received at Southampton, in the beginning of May of the above year, on his return from Paris. The same substance was shown in London to Mr. A. A. Luckerstein before it was delivered to the Royal Asiatic Society."

(True Copies) J. D'ALMEIDA.

(Copy)

Royal Asiatic Society, 5, New Burlington Street,
London, 3rd September, 1858

Extract from the list of "Donations to the Royal Asiatic Society, from April, 1842, *to June,* 1844" (Vide Journal of the Society, vol. viii. page 15):—

"A riding whip made of the concrete milk of a tree indigenous in Singapore, called Gutta Percha by the Malays; also the concrete milk in the lump: it is made ductile by being placed in hot water: presented by Don Jose D'Almeida."

The specimen of the concrete milk above-named is still preserved in the Museum of the Royal Asiatic Society, and a label pasted upon it states that it was deposited in April, 1843.

(Signed) WILLIAM NEAL,
(For Secretary).

P.S.—A piece of the above-mentioned specimen of Gutta Percha was given to Dr. J. F. Royle, but I am not aware that he made any experiments upon it.

(Signed) W. N.

ON THE HARDNESS OF METALS AND ALLOYS.

By F. Crace Calvert, M.R.A. of Turin, F.C.S., &c.; and Richard Johnson, F.C.S., &c.

[Read before the Literary and Philosophical Society of Manchester.]

The process at present adopted for determining the comparative degree of hardness of bodies, consists in rubbing one body against another, and that which indents or scratches the other is admitted to be the harder of the two bodies experimented upon. Thus, for example:—

Diamond,
Topaz,
Quartz,
Steel,
Iron,
Copper,
Tin,
Lead,

This method is not only very unsatisfactory in its results, but it is also inapplicable for determining with precision the various degrees of hardness of the different metals and their alloys. We therefore thought that it would be useful and interesting if we were to adopt a process which would enable us to represent by numbers the comparative degrees of hardness of various metals and their alloys.

To carry out these views we devised the following apparatus and method of operating. The machine used is on the principle of a lever, with this important modification, that the piece of metal experimented upon can be relieved from the pressure of the weight employed without removing the weight from the end of the longer arm of the lever. The machine consists of a lever, with a counterpoise and a plate, on which the weights are gradually placed; the fulcrum bears on a square bar of iron, passing through supports. The bar is graduated, and has at its end a conical steel point, 7*mm.* or 0·275 of an inch long, 5*mm.* or 0·197 of an inch wide at the base, and 1·25*mm.* or 0·049 of an inch wide at the point which bears on the piece of metal to be experimented on, and this is supported on a solid piece of iron. The support, or point of resistance is lowered or raised by a screw, and when, therefore, this screw is turned, the whole of the weight on the lever is borne by the support and the screw. When it is necessary, by turning the screw the weight on the lever is re-established on the bar, and experimented upon.

When we wished to determine the degree of hardness of a substance, we placed it on the plate, and rested the point upon it, noticing the exact mark on the bar, and then gradually added weights on the end of the lever until the steel point entered 3·5*mm.* or 0·128 of an inch during half an hour, and then read off the weight. A result was never accepted without at least two experiments being made, which corresponded so far as to present a difference of only a few pounds. The following table gives the relative degree of hardness of some of the more common metals. We specially confine our researches to this class, wishing the results to be practically useful to engineers and others who have to employ metals, and often require to know the comparative hardness of metals and alloys.

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[*] Mr. Oxley evidently confounds the Royal Asiatic Society with the Society of Arts. It was the latter Society which awarded the Gold Medal to Dr. Montgomerie.—Ed. *S. of A. Journal.*

Names of Metals.	Weight Employed.	Calculated Cast Iron = 1000.
Staffordshire Cold Blast Cast Iron—Grey, No. 3..........	4800 lbs.	1000
Steel................................	4600 ?	958 ?
Wrought Iron*	4550	948
Platinum..........................	1800	375
Copper—pure	1445	301
Aluminium.........................	1300	271
Silver—pure.......................	1000	208
Zinc ,, ...	880	183
Gold ,, ...	800	167
Cadmium ,, ...	520	108
Bismuth ,, ...	250	52
Tin ,, ...	130	27
Lead ,, ...	75	16

* This wrought iron was made from the above-mentioned cast iron.

This table exhibits a curious fact, viz., the high degree of hardness of cast iron as compared with that of all other metals, and although we found alloys which possessed an extraordinary degree of hardness, still none were equal to cast iron.

The first series of alloys we shall give is that of copper and zinc.

Formulæ of Alloys and per centages.	Weight Employed.	Obtained Cast Iron = 1000.	Calculated* Cast Iron = 1000.
	lbs.		
$ZnCu_5$ Cu 82·95 Zn 17·05 ...	2050	427·08	280·83
$ZnCu_4$ Cu 79·56 Zn 20·44 ...	2250	468·75	276·82
$ZnCu_3$ Cu 74·48 Zn 25·52 ...	2250	468·75	276·04
$ZnCu_2$ Cu 66·06 Zn 33·94 ...	2270	472·92	261·04
$ZnCu$ Cu 49·32 Zn 50·68 ...	2900	604·17	243·33
$CuZn_2$ Cu 32·74 Zn 67·26 ...	Broke with 1500 lbs. without the point entering.		
$CuZn_3$ Cu 24·64 Zn 75·36 ...	Broke with 1500 lbs. with an impression ½ *mm.* deep.		
$CuZn_4$ Cu 19·57 Zn 80·43 ...	Entered a little more than the above; broke with 2000 lbs.		
$CuZn_5$ Cu 16·30 Zn 83·70 ...	Entered 2 *mm.* with 1500 lbs.; broke with 1700 lbs.		

* To calculate the hardness of an alloy we multiplied the per centage quantity of each metal by the respective hardness of that metal, added the two results together, and divided by 100. The quotient is the theoretical hardness.

These results show that all the alloys containing an excess of copper are much harder than the metals composing them, and, what is not less interesting, that the increased degree of hardness is due to the zinc, the softer metal of the two which compose these alloys. The quantity of this metal must, however, not exceed 50 per cent. of the alloy, or the alloy becomes so brittle that it breaks as the steel point penetrates. We believe that some of these alloys, with an excess of zinc, and which are not found in commerce owing to their white appearance, deserve the attention of engineers. There is in this series an alloy to which we wish to draw special attention, viz., the alloy Cu Zn, composed in 100 parts of

Copper	49·32
Zinc	50·68
	100·00

Although this alloy contains about 20 per cent. more zinc than any of the brasses of commerce, still it is, when carefully prepared, far richer in colour than the ordinary alloys of commerce. The only reason that we can give why it has not been introduced into the market is, that when the amount of zinc employed exceeds 33 per cent., the brass produced becomes so white that the manufacturers have deemed it advisable not to exceed that proportion. If, however, they had increased the quantity to exactly 50·68 per cent., and mixed the metals well, they would have obtained an alloy as rich in colour as if it had contained 90 per cent. of copper, and of a hardness three times as great as that given by calculation. In order to enable engineers to form an opinion as to the value of this cheap alloy, we give them the degrees of hardness of several commercial brasses:—

Commercial Brasses.		Weight employed.	Cast Iron = 1000.	
			Obtained.	Calculated
		lbs.		
"Large Bearing"	Copper 82·05 *Tin... 12·82 Zinc... 5·13	2700	562	259
"Mud Plugs" ...	Copper 80 *Tin... 10 Zinc ... 10	3600	750	262
"Yellow Brass"..	Copper 64 Zinc ... 36	2500	520	258
"Pumps & Pipes"	Copper 80·0 *Tin... 5·0 Zinc... 7 5 Lead... 7·5	1650	343	257

* These alloys all contain tin.

The alloy Cu Zn possesses another remarkable property, viz., the facility with which it is capable of crystallising in prisms half an inch in length, of extreme flexibility. There is no doubt that this alloy is a definite chemical compound, and not a mixture of metals, as alloys are generally considered to be. Our researches on the conductibility of heat by alloys, recently presented to the Royal Society, leave no doubt that many alloys are definite chemical compounds.

ON BRONZE ALLOYS.

Formulæ of Alloys and per centages.	Weight Employed.	Obtained Cast Iron = 1000.	Calculated Cast Iron = 1000.
	lbs.		
$CuSn_5$ Cu 9·73 Sn 90·27	400	88·33	51·67
$CuSn_4$ Cu 11·86 Sn 88·14	460	95·81	59·56
$CuSn_3$ Cu 15·21 Sn 84·79	500	104·17	68·75
$CuSn_2$ Cu 21·21 Sn 78·79	650	135·42	84·79
$CuSn$ Cu 34·98 Sn 65·02	At 700 lbs. the point entered one half and the alloy broke.		
$SnCu_2$ Cu 48·17 Sn 51·83	At 800 lbs. the alloy broke without the point entering.		
$SnCu_3$ Cu 61·79 Sn 38·21	At 800 lbs. the alloy broke in small pieces (blue alloy).		
$SnCu_4$ Cu 68·27 Sn 31·73	1300 lbs. divided the alloy in two, point not entering 1 *mm.*		
$SnCu_5$ Cu 72·90 Sn 27·10	The same as the preceding.		
$SnCu_{10}$ Cu 84·32 Sn 15·68	4400	916·66	257·08
$SnCu_{15}$ Cu 88·97 Sn 11·03	3710	772·92	270·83
$SnCu_{20}$ Cu 91·49 Sn 8·51	3070	639·58	277·70
$SnCu_{25}$ Cu 93·17 Sn 6·83	2890	602·08	279·16

The results obtained from this series of alloys lead to several conclusions deserving our notice. First, the marked softness of all the alloys containing an excess of tin; secondly, the extraordinary fact that an increased quantity of so malleable a metal as copper should so suddenly render the alloy brittle, for the

Alloy $Cu\ Sn_2$
or
$\left.\begin{matrix}\text{Copper ......} & 21{\cdot}21\\ \text{Tin ....} & 78{\cdot}79\end{matrix}\right\}$ is not brittle,
whilst the alloy Cu Sn
or
$\left.\begin{matrix}\text{Copper ......} & 34{\cdot}98\\ \text{Tin ....} & 65.02\end{matrix}\right\}$ is brittle.

Therefore the addition of 14 per cent. of copper renders a bronze alloy brittle. This curious fact is observed in all the alloys with excess of copper, $Sn\ Cu_2$, $Sn\ Cu_3$, $Sn\ Cu_4$, $Sn\ Cu^5$, until we arrive at one containing a great excess of copper, viz., the alloy $Sn\ Cu_{10}$, consisting of copper 84·68 and tin 15·32, when the brittleness ceases; but, strange to say, this alloy, which contains four-fifths of its weight of copper, is, notwithstanding, nearly as hard as iron. This remarkable influence of copper in the bronze alloys is also visible in those composed of

$Sn\ Cu_{15}$, containing 88·97 of copper.
$Sn\ Cu_{20}$, ,, 91·49 ,,
$Sn\ Cu_{25}$, ,, 93·17 ,,

Copper acquires such an increased degree of hardness by being alloyed with tin or zinc, that we thought it interesting to ascertain if alloys composed of these two metals would also have a greater degree of hardness than that indicated by theory; we accordingly had a series of alloys prepared in equivalent quantities, and these are the results arrived at:—

Formulæ of Alloys and per centages of each.	Weight Employed.	Obtained Cast Iron = 1000.	Calculated Cast Iron = 1000.
	lbs.		
$Zn\,Sn_2 \left\{\begin{matrix}Zn\ 21{\cdot}65\\ Sn\ 78{\cdot}35\end{matrix}\right\}$	300	64·50	60·83
$Zn\,Sn \left\{\begin{matrix}Zn\ 35{\cdot}60\\ Sn\ 64{\cdot}40\end{matrix}\right\}$	330	68·75	82·70
$Sn\,Zn_2 \left\{\begin{matrix}Sn\ 47{\cdot}49\\ Zn\ 52{\cdot}51\end{matrix}\right\}$	400	83 33	110·00
$Sn\,Zn_3 \left\{\begin{matrix}Sn\ 37{\cdot}57\\ Zn\ 62{\cdot}43\end{matrix}\right\}$	450	93·70	124·58
$Sn\,Zn_4 \left\{\begin{matrix}Sn\ 31{\cdot}14\\ Zn\ 68{\cdot}86\end{matrix}\right\}$	505	105·20	131·22
$Sn\,Zn_5 \left\{\begin{matrix}Sn\ 26{\cdot}57\\ Zn\ 73{\cdot}43\end{matrix}\right\}$	600	125·00	142·08
$Sn\,Zn_{10} \left\{\begin{matrix}Sn\ 15{\cdot}32\\ Zn\ 84{\cdot}68\end{matrix}\right\}$	580	120·83	158·33

These results show that these metals exert no action on each other, as the numbers indicating the degrees of hardness of their alloys are rather less than those required by theory. Our researches on the conductibility of heat by the three above series of alloys throw, we believe, some light on the great difference which the alloys of bronze present as compared with those of tin and zinc; for we have stated above that the latter conduct heat as a mixture of metals would do, and not as the former series, which conduct heat as definite chemical compounds.

We shall conclude by giving the degrees of hardness of two other series of alloys, viz., those composed of lead and antimony, and lead and tin. In the series of lead and tin we find that tin also increases the hardness of lead, but not in the same degree as it does that of copper.

Lead and Antimony.

Formulæ of Alloys and per centages.	Weight Employed.	
	lbs.	
$Pb\,Sb_5 \left\{\begin{matrix}Pb\ 24{\cdot}31\\ Sb\ 75{\cdot}69\end{matrix}\right\}$ ..	....	Entered 2·5*mm.* with 800 lbs.; then broke.
$Pb\,Sb_4 \left\{\begin{matrix}Pb\ 28{\cdot}64\\ Sb\ 71{\cdot}36\end{matrix}\right\}$ ..	....	Entered 2·7*mm.* with 800 lbs.; broke with 900 lbs.
$Pb\,Sb_3 \left\{\begin{matrix}Pb\ 34{\cdot}86\\ Sb\ 65{\cdot}14\end{matrix}\right\}$ ..	875	
$Pb\,Sb_2 \left\{\begin{matrix}Pb\ 44{\cdot}53\\ Sb\ 55{\cdot}47\end{matrix}\right\}$ ..	....	Entered 2·5*mm.* with 500 lbs.; broke with 600 lbs.
$Pb\,Sb \left\{\begin{matrix}Pb\ 61{\cdot}61\\ Sb\ 38{\cdot}39\end{matrix}\right\}$ ..	500	
$Sb\,Pb_2 \left\{\begin{matrix}Pb\ 76{\cdot}32\\ Sb\ 23{\cdot}68\end{matrix}\right\}$ ..	385	
$Sb\,Pb_3 \left\{\begin{matrix}Pb\ 82{\cdot}80\\ Sb\ 17{\cdot}20\end{matrix}\right\}$ ..	310	
$Sb\,Pb_4 \left\{\begin{matrix}Pb\ 86{\cdot}52\\ Sb\ 13{\cdot}48\end{matrix}\right\}$ ..	300	
$Sb\,Pb_5 \left\{\begin{matrix}Pb\ 88{\cdot}92\\ Sb\ 11{\cdot}08\end{matrix}\right\}$ ..	295	

Lead and Tin.

Formulæ of Alloys and per centages.	Weight Employed.	Obtained Cast Iron =1000.	Calculated Cast Iron =1000.
	lbs.		
$Pb\,Sn_5 \left\{\begin{matrix}Pb\ 26{\cdot}03\\ Sn\ 73{\cdot}97\end{matrix}\right\}$	200	41·67	23·96
$Pb\,Sn_4 \left\{\begin{matrix}Pb\ 30{\cdot}57\\ Sn\ 69{\cdot}43\end{matrix}\right\}$	105	40·62	23·58
$Pb\,Sn_3 \left\{\begin{matrix}Pb\ 36{\cdot}99\\ Sn\ 63{\cdot}01\end{matrix}\right\}$	160	32·33	22·83
$Pb\,Sn_2 \left\{\begin{matrix}Pb\ 46{\cdot}82\\ Sn\ 53{\cdot}18\end{matrix}\right\}$	125	26·04	20·09
$Pb\,Sn \left\{\begin{matrix}Pb\ 63{\cdot}78\\ Sn\ 36{\cdot}22\end{matrix}\right\}$	100	20·83	19·77
$Sn\,Pb_2 \left\{\begin{matrix}Pb\ 77{\cdot}89\\ Sn\ 22{\cdot}11\end{matrix}\right\}$	125	26·04	18·12
$Sn\,Pb_3 \left\{\begin{matrix}Pb\ 84{\cdot}09\\ Sn\ 15{\cdot}91\end{matrix}\right\}$	135	28·12	17·23
$Sn\,Pb_4 \left\{\begin{matrix}Pb\ 87{\cdot}57\\ Sn\ 12{\cdot}43\end{matrix}\right\}$	125	26·04	17·08
$Sn\,Pb_5 \left\{\begin{matrix}Pb\ 89{\cdot}80\\ Sn\ 10{\cdot}20\end{matrix}\right\}$	110	22·92	16·77

We have great pleasure in thanking here Mr. Siméon Stoikowitsch, F.C.S., for his valuable assistance during these long researches.

STEPHENSON MEMORIAL SCHOOLS.

The laying of the foundation stone of the memorial schools to George Stephenson, about to be built at Willington, near Newcastle-on-Tyne, took place on Tuesday, the 16th November.

The site contains a quarter of an acre, with a good frontage of 100 feet towards the river, and was a present from the Corporation of Newcastle. The buildings consist of school-rooms for boys, girls, and infants, with a house for a master and mistress attached, and a large library and reading room for the use of the neighbourhood. The total cost will exceed £2,000. The plans have been approved by the Government, who assist the scheme by a grant.

There were present at the ceremony Joseph Laycock, Esq., Mayor of Newcastle; E. Potter, Esq., of Cramlington Hall, Mayor of Tynemouth; Thomas Sopwith, Esq., of Allenheads; Mrs. and Miss Sopwith; Mr. and Mrs. Addison Potter, &c., &c.

The stone was laid by Mrs. Addison Potter, the inscription upon it stating that

"The building occupies the site of the dwelling-house formerly the residence of George Stephenson, in which his son Robert Stephenson was born on the 16th of November, 1803."

After the stone had been laid and a prayer offered up, Mr. Addison Potter said that an intimate friend, not only of Mr. Robert Stephenson, but also of the late George Stephenson, was present, Mr. Sopwith, whom he would call upon to address the meeting.

Mr. SOPWITH responded to the call, and in the course of his speech observed that among the incidents of George Stephenson's life, that which most chiefly concerned the occasion of the present meeting was, that of his having in the year 1802 come to reside upon the very spot where he (Mr. Sopwith) was now standing—and in the following year, 1803, upon that very day, November 16th, his son Robert Stephenson was there born. He thought this was a circumstance of which the inhabitants of the locality might be justly proud, for it was a spot which in future ages would be looked upon with interest, as connected with the history of these two great men. He dwelt at some length upon the early struggles of George Stephenson, his anxiety for knowledge, and the sacrifices he made in order to give a good education to his now distinguished son. After speaking of the interest which Mr. Robert Stephenson himself took in the progress of education, Mr. Sopwith concluded by expressing a hope that everything would be done in those schools with a view to promote the glory of God, as well as the good estate and condition of the children who were educated there.

A vote of thanks was then passed to Mrs. Addison Potter, on the motion of the Mayor of Newcastle, which having been duly acknowledged by Mr. Addison Potter, the meeting separated.

Colonial Correspondence.

EMIGRATION TO BRITISH HONDURAS.

Belize District, 17th October, 1858.

SIR,—I forward to you a letter which I have received from two coloured persons residing at Detroit, Michigan, United States. Their wish is to emigrate to some country where their complexion will not operate against their rising in the world, and where they will not be subject to the taunts and indignities which all belonging to their race must suffer in America. I also send you my reply to their letter.

Detroit, Mich., August 5, 1858.

GENTLEMEN,—We have been by friends advised to emigrate to Central America, and on the account of it we wrote lately to W. Stevenson, Esq., for such information as would lead us to a suitable part of the country. If you are in any way acquainted with the institutions that exist in the United States, you know that near 4,000,000 slaves * * * this country, whose soil is stained with their blood, and you also know that we, of the pretended free north, are their descendants, part of their blood, and are bound in one common cause to each other, that is politically and socially, but the experience of years of painful anxiety has satisfied us that, side by side with our brethren, we can do them but little good, and nothing for ourselves or our race. We have been advised to try to find a home in some other country, as we hold a position in this that no intelligent people can longer endure. We are not only, gentlemen, suffering socially and politically, but every avenue of wealth is most effectually closed against the coloured men of the country, thus making us constantly dependent, and not in any way self-sustaining. This poverty arises from the proscription we suffer, which keeps us out of all lucrative employment. Indolence is not a characteristic of the negroes of America, since if they had equal chance here with the white man, they would make the same proficiency in acquiring wealth. But to leave that dark and unpleasant picture, let us for a moment look at the future of the American negro. This question, more that any other question, now occupies our minds,—what is our duty as parents and brethren of the same race and complexion? What course shall we enter upon is now the question of the most vitality. We have been the most favourably impressed with the Central American states, and as such is our mind, we are in want of main facts by the which we can make our selection of a home. We do not believe, gentlemen, that we appeal to those who will not give us their early attention in so important a matter as the selection of a home. We are not soliciting for sympathy or benevolence, but that we may have a place where we may by our strong arm work ourselves up to that position to demand respect from all who may chance to make our acquaintance. You, or either of you, will then confer on us a favour by writing and letting us know what in your power you can that will be of interest to our emigration to Central America, and what season of the year would you advise us to come in, and to what state or county. You know what information a stranger wants, all of which we ask you. We did write to Mr. Stephenson some weeks ago, and now we write to you, and hope to hear from both soon. We want farming land, navigable streams, water power, and so forth. Please give this your early attention, and much oblige

Yours truly,
(Signed) J. M. WILLIAMS.
WM. E. MONRO.

[REPLY.]

Belize, B. Honduras, October 17th, 1858.

SIRS,—Your letter, addressed to myself and others, and dated "Detroit, Michigan, August 5th," I have just received.

You state that in the United States there is no avenue by which you and your brethren can arrive at a position of independence; that you have been advised to emigrate to Central America, and that you wish me to give you information respecting that country, and what period of the year would be the best in which to proceed to it. I have much pleasure in furnishing you with the information which you require. That portion of the Isthmus which is denominated Central America consists of five independent states, viz., Guatemala, Costa Rica, San Salvador, Nicaragua, and Honduras. Each possesses a republican form of government, an elected president being at the head of it for a limited period. The country is very mountainous, extremely fertile, and in some parts most salubrious. The inhabitants are a mixture of the old Spaniard and the aboriginal Indian. They are indolent, treacherous, sanguinary, and cruel. With every advantage which nature could bestow upon it, the country has not progressed; on the contrary, it has retrograded from the position which it held whilst it was under the dominion of Spain. Since their revolt from the mother country, the different states have almost constantly been at war with each other, whilst the vitals of each have been devoured by internal struggles for political power, during which human blood has flowed like water. In every one of the states life and property are alike unprotected. In addition to these scourges of the country, some of the states have recently been invaded by American filibusters, who, in their ruthless course, have respected no laws human or divine, have burnt towns to ashes, have desecrated churches, and put to death men, women, and children.

It is not surprising that during such a state of things agriculture and commerce should have been almost entirely neglected. I could not counsel you to settle in such a country. Nay, as you have asked me for advice and information, I should not be acting rightly if I did not attempt to dissuade you from the step. Far better would it be to remain in the land which gave you birth, although that land is, as you say, "Stained with the blood of the slave." There, although you may be subjected to many indignities, although you may not be able to raise yourselves in the social scale, still you cannot be deprived of your lives and property so long as you do not transgress the law.

But if you are sincerely desirous of emigrating to a country where, by honest industry, you may be able to better your condition, where there is no distinction of races, where the white and the black man are equally protected by the law, let me earnestly invite you to British Honduras. Here, under the benign sway of Queen Victoria, and governed by British laws, you may pursue your various callings, and arrive at a position which shall command the respectful consideration of your fellow-citizens.

You say that you require farming land, navigable streams, and water power. All these exist in the greatest abundance in British Honduras. The land, which is a perfectly virgin soil, is capable of producing everything which grows in a tropical country. The sugar cane, cotton, coffee, rice, cacao, &c., grow here in perfection. One planting of the cane will last three years, and the cotton of this country has been pronounced to be as good as that of the Southern States of America. If you and your brethren—as many as you like—hundreds, thousands—will come here with stout hearts and determined minds, the government will lease you crown land for the purpose of cultivation at a rent of one dollar a year for every two acres. I must, however, tell you that this land you will have to clear, and labour here is very scarce. To use your own expression, you must "by your own strong arm work yourselves up to a position to command the respect of all who make your acquaintance." You may come at any season of the year.

I am, &c.,
R. TEMPLE,
Chief Justice of British Honduras.

I sincerely hope that Mr. Williams, Mr. Monro, and friends and brethren may be induced to emigrate to this country. Two shillings a year for every acre of rich virgin land is surely a low rent enough, and if the men are really in earnest, they will not fail to avail themselves of so advantageous an offer. But this offer is not merely made to them, it is made to the industrious poor in every part of the world. It is made to the poor Irishman, whose squalid wretchedness, whose famished children, whose sick wife drive to the commission of crime. It is made to these miserable mechanics who, —when the ground is hardened by the frost—when the bricklayer and the mason are obliged to throw down the plummet and the trowel—when the gardener is compelled to cast aside his spade, besiege the metropolitan police officers, demanding bread. It is made to those denizens of the London alleys whose trade is pocket-picking. It made to the dwellers in Edinburgh wynds and closes, to whom the pure untainted breath of heaven seldom comes. If indolence and vice have not become settled habits with them; if all taste for honesty be not completely gone; if the bread of honourable toil has yet some remains of sweetness to their palate—let them come here, and they shall be rescued from the tempter who, in different ways, and by various baits, is leading them on by imperceptible degrees to their destruction. Two acres of rich land, which the spade has never yet penetrated, for four shillings a year, they shall have. Two acres of land on which they may grow sugar, cotton, coffee, maize, rice, tobacco, arrow-root, cassava, peppers, oranges, figs, pine-apples, melons, cocoa-nuts—on which they may breed stock of every kind. Anglo-Saxons and Celts, with sandy locks or raven hair, with blue eyes or black, wherever you are, in Irish hovels, Edinburgh holes, in London styes—I say to you, come. Leave off pocket-picking and poaching; leave off sniggling hares, netting partridges, and administering to the trout and the salmon doses of Cocculus Indicus, forget Mr. Smith's strong box and Mrs. Robinson's silver spoons; leave off wallowing in the filth of metropolitan vice and sensuality; leave off begging and telling your piteous fables, and pinching your "babbies" until they are black and blue; you limping fellow, throw away your crutches and let down your leg; you blind man, open your great, grey, goggle eyes; you with the withered arm, untie that bandage, and come, one and all, to a country where the means will be afforded you of becoming good men and true, and of making a proper use of that reason which God has given to you, and which ought gloriously to distinguish you from the brutes that perish, but which, alas! has either been used to enable you dexterously to infringe God's laws and man's laws, or else has been drowned and extinguished by your own depraved tastes and habits. If there be a spark of your original nature left in you, a spark of that nature which you received at your birth, you will not omit to take advantage of an offer which will enable you to become respectable, and, perhaps, wealthy members of society.

It is a mistake to suppose that the white man cannot work in the tropics. He can work better than the negro, and with as little injury to his constitution. The belief originated in idleness and pride. The first settlers in the New World were Spaniards; they were soldiers—they were robbers—they wished to possess themselves of the treasures of the country which they had discovered; they were ready to fight for them, for these plunderers were brave, but they disdained to acquire them by ignoble toil. "Gold, gold," was their cry, "bring us gold." They would ford rivers; they would climb precipitous rocks; they would penetrate almost impervious forests; they would march through the burning sun of noon; they would repose under the chilling dews of night—for gold—but they would not till the earth. Cutting and slaying was an honourable employment, but turning up the soil was degrading; the sword was the weapon of a gentleman, but the spade was the implement of a serf; they would cut a throat and sing Io Pæan—but to dig they were ashamed. But could they not have worked if they had chosen? Did they not work? Who built those strong, frowning fortresses which are yet standing in various parts of Central America and the West Indies? Who erected those splendid cathedrals which are everywhere to be met with in the New World? It is utter nonsense to say that the negro only can labour in the tropics. The planters of the Southern States of America will tell you so, because it is an excuse (they think) for slavery. The planters of Cuba will tell you so, because it is an excuse for indolence. What has a labourer to contend against in the tropics?—The blazing sun; granted. But he need not work in the blazing sun. If he labour from five o'clock in the morning until ten, and from three o'clock in the afternoon until six, he will entirely escape the blazing sun. Is there any other impediment for him to encounter?—None, except brandy. But what are the evils to which a labourer is exposed in England or Scotland? —Snow, sleet, rain, the cold north and the cutting east wind; and when his work is done a meagre supper, a fireless grate, a hard straw mattress covered with a thin ragged rug on which to repose his cold, weary shivering, bones. And what are the consequences of all this?—Rheumatism, catarrh, sore-throat, pleurisy, consumption, which the tropical labourer never hears of. Tell me not that the European is not able to labour in the tropics.—I am, &c., R. TEMPLE.

Proceedings of Institutions.

WHITBY INSTITUTE.—The thirteenth annual report of the Institute of Popular Arts, Science, and Literature, states that the revenue from subscriptions is in advance of the preceding year, and has attained a point which it has never reached in any former period. The total balance in the treasurer's hands is £56 0s. 2d.; being £22 11s. 10d. more than the sum received from last year's accounts. This is independent of a year's interest due upon £120 remaining in the bank, which has not this year been disturbed. The donation of £10 by Robert Stephenson, Esq., was given for the exclusive benefit of the library, and has been appropriated to that object. A decline of 258 books has taken place in the issues of books as compared with last year, the total number being 3354. In the class department a considerable degree of success has been attained. The general instruction and navigation class was well attended throughout, the average number being 41. The productions in architectural drawing were highly creditable. A German class, under the voluntary tuition of Mr. D. Elias, a German, has been most successful. An essay class was formed at the end of the winter, and produced some well digested and well written papers. It will be one of the tasks of the incoming body of directors, in conjunction with the class committee, to adapt the instruction of the classes, so that students may be able to prepare themselves for the annual examinations of the Society of Arts.

MEETINGS FOR THE ENSUING WEEK.

MON.......Actuaries, 7. I. "On the Improvement of Life Contingency Calculation." II. "The system of Dependent Risks." By Mr. Farren.
London Institution, 7. Prof. Tyndall, "On Light."
British Architects, 8.
TUES. ...Civil Engineers, 8. Discussion, "On Steep Inclines on American Railways." And, if time permits, Mr. M. Scott, M. Inst. C.E., "Description of a Breakwater at the Port of Blyth, &c."
WED. ...London Institution, 3. Mr. Thomas R. Jones, "On the Natural History of the Vertebrate-Division of the Animal Kingdom."
Zoological, 3.
Society of Arts, 8. Mr. Hyde Clarke, "On Copper Smelting."
Geological, 8 Sir R. I. Murchison, F.R.S., "On the Geological Structure of the North of Scotland, and the Orkney and Shetland Isles."
THURS....London Institution, 7. Dr. E. Frankland, "On the Air and Water of Towns."
Chemical, 8. I. Mr. Mercer, "On Atomic Weights." II. Mr Barratt, "On the Analysis of the Water from Holywell, North Wales."
Linnæan, 8. I. Mr. S. Hanley, "On the Linnæan MS. of the Museum Ulricæ." II. Prof. Henfrey, "On the Morphology of the Balsaminaceæ."
FRI. ......Archæological, 4.
SAT. ......London Institution, 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Nov.* 19, 1858.]

Dated 29th September, 1858.

2162. E. L. Benzon, Sheffield—Imp. in the manufacture of steel. (A com.)

Dvted 27th September, 1858.

2172. G. T. Bousfield, Louughborough-park, Brixton—Imp. in apparatus for and in the manufacture of paper bags and other similar articles. (A com.)

Dated 1st October, 1858.

2190. T. Preston, Nottingham—Imp. in the manufacture of looped fabrics.

Dated 8th October, 1858.

2236. E. V. Rippingille, Chorlton-upon-Medlock, Greenheys, Manchester—The imp. of fire-arms and artillery.

Dated 20th October, 1858.

2342. P. C. Stortz, Havelock-buildings, Bold-street, Liverpool—Imp. in the materials of photographic plates.

Dated 21st October, 1858.

2350. C. W. Williams, and G. Eyton, Liverpool—Imp. in the construction of locomotive and other steam-boilers.

Dated 27th October, 1858.

2394. L. Wray, 5 Devonshire-street, Portland-place—The preparation and application of a substitute for gutta percha, caoutchouc, and similar substances.

Dated 1st November, 1858.

2430. C. Vero and J. Everitt, Atherstone, Warwickshire—Imp. in the manufacture of hats and other coverings for the head, a part of which imp. is also applicable to the manufacture of felt.
2432. J. Dobson and D. Pearce, St. James.-street—Imp. in the manufacture of bird-cages.
2434. E. Maynard, Brooklyn, New York, U.S.—Imp. in submarine telegraph cables.
2436. W. Palmer, New York, U.S.—Imp. in fire-arms.

Dated 2nd November, 1858.

2440. D. Tomasini, Store-street, Bedford-square—Imp. in respirators.
2442. R. C. Smith, Birmingham—A new or improved buoy or wreck intelligencer.
2444. M. L. J. Lavator, Strand—Imp. in cartridges for military and other purposes.
2446. D. D. Kyle, Albany-street, Regent's-park—Imp. in boots and shoes.
2448. A. McDougall, Manchester—Imp. in the construction of reservoirs, tanks, culverts, seawalls, and other erections required to exclude water or damp.

Dated 3rd November, 1858.

2450. S. Bottomley, Bradford—Imp. in the manufacture of moreens and other fabrics of a similar character.
2452. H. T. Moret, 1B, Welbeck-street, Cavendish-square—The application of a mineral, named Deterso, as a disinfecting, preserving, absorbing, and curative powder.
2454. J. Tall, Collingwood-street, Blackfriars-road—Imp. in brushes or brooms for sweeping floors, carpets, and other similar articles.
2456. P. A. Mawdsley, Seacombe—Improved machinery or apparatus for drying yarns after being sized or stiffened, and the use or application of a certain substance or substances, in the sizing, stiffening, or otherwise preparing yarns and woven fabrics, or either of them.
2458. J. Fowler, jun., R. Burton, and D. Greig, Cornhill—Imp. in applying motive power to actuate ploughs and other agricultural implements.

Dated 24th November, 1858.

2460. E. Fielding, Todmorden, Lancashire—An improved method of preserving the form of cops of yarn by the application of adhesive substances.
2462. C. F. Vassero,, Essex-street, Strand—Improved driving machinery applicable for thrashing grain and other agricultural purposes. (A com.)
2464. J. R. Napier, Glasgow—Imp. in obtaining motive power by means of heat.
2466. W. T. Mabley, Manchester—Imp. in printing and dying woven fabrics. (A com.)
2468. I. Baggs, Kennington—Imp. in telegraphing by electricity.

Dated 5th November, 1858.

2470. W. H. Tooth, Lampeter-street, Islington—Imp. in the manufacture and construction of fire or furnace bars.
2472. T. B. Smith, Marietta, U.S.—Preparing wood, so as to be used as a substitute for curled hair, in the manufacture of mattrasses, and in the other purposes to which curled hair and its substitutes are applied.
2474. E. Rowland and J. Dewhurst, Manchester—Certain imp. in steam-engines, and in the valves connected therewith, which said improvements in valves are also applicable to safety valves.
2476. C. Mills, 8, High-street, Camden-town—Imp. in the action of pianofortes.
2478. S. Davey, Rouen, France—Imp. in blasting powder.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

2560. T. R. Butcher, F. Stevens, W. T. Johnson, and T. Jarvis, Frome, Somersetshire—Imp. in the hammer rails of pianofortes.—15th November, 1858.
2575. C. J. C. Perry, Williamstown, Victoria—An instrument to be used chiefly on board ship for approximating in certain cases the course of an approaching vessel, either in the day or night, and the relative angle of both ships' courses to avoid a collision, to be called "Perry's anti-collision dial."—16th November, 1858.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Nov.* 19, 1858.]

November 19th.

856. J. M. Rowan and T. R. Horton.
1123. M. Brun.
1125. H. Brierly.
1131. F. C. Bakewell.
1136. S. Bryer.
1140. P. Féron.
1150. G. White.
1151. A. Ellissen.
1152. I. Baggs.
1164. G. W. Morse.
1192. W. Clark.
1226. J. Austin & J. Armstrong.
1235. J. Mannhardt.
1264. J. H. Johnson.
1980. A. V. Newton.
1990. W. E. Newton.

[*From Gazette, Nov.* 23, 1858.]

November 23rd.

1155. R. L. Hattersley.
1163. W. Webster.
1165. W. Webster.
1170. J. F. Belleville.
1171. J. Courage.
1184. P. A. Fourgassié.
1185. M. Henry.
1203. L. Tindall.
1217. M. Henry.
1219. J. Young and J. Strang.
1242. R. Roberts and W. Shaw.
1251. J. Mitchell.
1260. E. Cooke & G. Dickenson.
1331. L. F. Lemière.
1341. J. H. Young.
1347. J. C. Henderson.
1367. G. Davies.
1373. A. Dawson.
1379. R. S. Newall.
1397. J. Crossley.
1406. G. Schaub.
1429. J. H. Johnson.
1559. J. Loach and J. Cox.
1599. T. Bartlett.
1951. G. White.
1985. J. Sloper.
2135. A. B. Childs.
2153. R. Romaine.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, Nov.* 19, 1858.]

November 15th.

2582. C. Crum and C. Paul.
2587. J. Yates and T. R. Birch.
2614. W. Harvey.
2856. A. Small.
2922. S. Sawyer.

November 16th.

2683. C. J. B. Barbier.
2799. R. A. Whytlaw and J. Steven.

November 17th.

2612. A. V. Newton.
2623. A. Tolhausen.

[*From Gazette, Nov.* 23, 1858.]

November 18th.

2541. T. Hitt.
2602. W. Smith.
2641. A. D. Lacy.

November 19th.

2617. E. O. W. Whitehouse.
2618. D. S. Price and E. C. Nicholson.
2619. D. S. Price and E. C. Nicholson.
2622. C. Defries.
2637. C. T. Dunlop.
2659. F. Coignet.
2664. J. Clark.

November 20th.

2631. J. Roberts, junr.
2639. C. May and P. Prince.